Will Farmland Values Keep Booming?

By Jason Henderson

Lean supplies, strong export activity, and vibrant demand both at home and abroad have pushed crop prices to record highs, offsetting today's spiraling production costs. As a result, farm profits and investments have soared, and farmland values have boomed.

But commodity markets in agriculture can change directions abruptly—and so agricultural bankers and farm analysts naturally question the sustainability of today's prosperity. The current agriculture boom is strikingly similar to those of the 1970s and mid-1990s, when the good times quickly faded as crop supplies increased, the dollar strengthened, and export activity weakened. One particular danger is that rising farmland values could be accompanied by greater financial leverage, increasing the industry's vulnerability to a drop in income, as in the 1980s.

This article discusses current farmland value trends and analyzes the factors underlying the recent surge. Section I compares the current run-up in farmland values with past agricultural booms. Section II explores the financial aftermath of previous booms. Section III explains the economic rationale for current farmland values. Section IV explores

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how unexpectedly higher input costs and lower crop prices can cut farmland values. The article concludes that the recent surge in farmland values tracks expected gains in crop returns. At the same time, however, an unexpected surge in production costs or a drop in crop prices could undercut farmland values and pose a financial risk to the farm sector. Thus far, however, the industry's debt levels are up only modestly, helping to mitigate the risks of a drop in farm incomes.

I. WHAT IS DRIVING HIGHER FARMLAND VALUES?

In 2007, farmland values soared, posting record gains in many regions of the Corn Belt. Lean crop supplies, strong ethanol demand, and vibrant export activity fueled by robust foreign economies and a weaker dollar have led to a spike in crop prices. Crop prices continue to soar in 2008, quickly translating into surging farmland values. The record farmland value gains, fueled by robust crop demand and lean supplies, are remarkably similar to the gains of past agricultural booms before debt accumulation undermined the financial health of the farm sector.

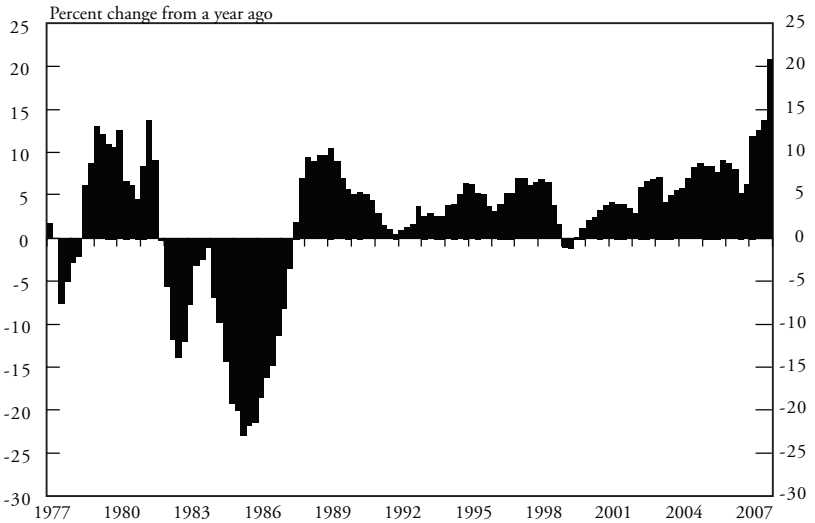
Farmland values surge

Over the past year, farmland values across the country have posted record gains. According to Federal Reserve surveys, farmland values are up more than 15 percent from a year ago. In the Kansas City Federal Reserve District, nonirrigated and irrigated cropland values in 2007 jumped 21 percent, the largest annual gain in survey history (Chart 1).[1] These gains have persisted through the first quarter of 2008. The Chicago Federal Reserve District also posted strong gains, with cropland values in 2007 rising 15 percent. Bankers in the Minneapolis, Dallas, and San Francisco districts have also reported surging farmland values.

Entering 2007, gains in farmland values were already brisk due to robust ethanol demand. The price of corn, the leading feedstock for ethanol plants, doubled and market competition for planted acres led markets to bid up prices for other crops. The strongest farmland value gains emerged in corn-producing regions where ethanol production was expanding. In the Kansas City District, farmland values strengthened first in Nebraska, where farmland values within 50 miles of an ethanol plant rose more than 30 percent over 2006 (Henderson and Akers; Henderson and Gloy). In the Chicago and Minneapolis districts, crop-

Chart 1

NONIRRIGATED CROPLAND VALUES KANSAS CITY FEDERAL RESERVE DISTRICT



Source: *Agricultural Credit Survey,* Federal Reserve Bank of Kansas City

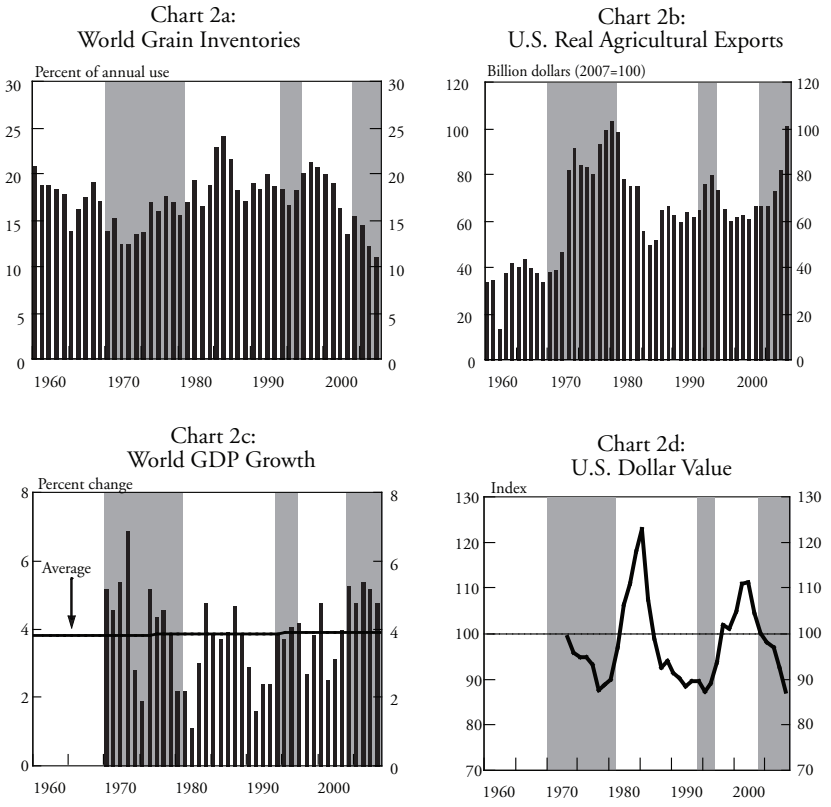
land values rose most sharply in western and north central Iowa, western Illinois, central Indiana, Minnesota, and South Dakota—in other words, in places where ethanol production was concentrated.

Throughout 2007, farmland value gains accelerated as crop supplies stayed lean and export demand pushed crop prices to record highs (Chart 2). After the fall harvest, world crop supplies dwindled further. To satisfy the ethanol demand, corn production in the Unites States rose sharply, limiting the production of wheat and soybeans. Droughts in Australia, Eastern Europe, and the southeastern Unites States further slashed production globally.

At the same time, ethanol's voracious appetite for corn trimmed crop inventories. Then, strong economic growth worldwide, coupled with the falling dollar, boosted U.S. agricultural exports, resulting in strong fourth quarter gains. By the end of 2007, world grain inventories dropped to historical lows and sent crop prices soaring. The spike in U.S. crop prices and profits quickly translated into record farmland value gains.

Chart 2

GRAIN INVENTORIES, AGRICULTURAL EXPORTS, ECONOMIC GROWTH AND DOLLAR VALUE



Source: USDA

Past agricultural booms

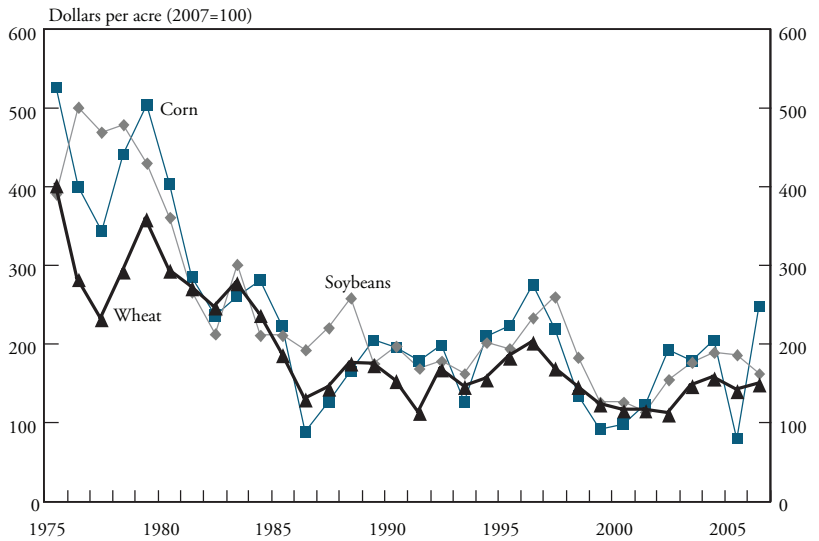
The combination of lean supplies and strong demand creating a boom in farmland values is not unusual. The booms in the 1970s and mid-1990s were also driven by record prices emerging from tight supplies and robust demand. Their short lives naturally raise concerns about the current run-up in crop prices.

The most pronounced agricultural boom since World War II occurred in the 1970s, when global food demand emerged as a force in agriculture. World economic growth expanded 4.5 percent annually during the decade, allowing people in developing countries to increase

Chart 3

HISTORICAL REAL NET RETURNS TO U.S. CROP PRODUCTION

(Market returns minus variable or operating costs)



Calculations based on USDA cost and returns data.
Variable costs exclude land, labor, machinery, taxes, insurance, and overhead costs.
Market returns exclude government payments.

their food consumption. In addition, a weak dollar made U.S. food products affordable in global markets. Supported by a Russian grain deal in 1972, U.S. agricultural exports rose fourfold in the decade. Strong demand outstripped supplies, and grain inventories fell to record lows, underpinning robust price gains. Corn prices established a new plateau, rising from $1.11 per bushel in the 1960s to $2.10 per bushel. Bigger net returns to crop production were quickly capitalized into record farmland values (Chart 3).

The tide quickly changed. Rising crop prices enticed farmers to expand crop acres and to boost agricultural productivity. World grain inventories soon overflowed. Then, in the 1980s, the global recession associated with the fight against inflation slashed world demand. The value of the dollar strengthened, making U.S. food products more expensive in global markets. An embargo of grain sales to the Soviet Union further limited export activity. As a result, U.S. agricultural exports dropped in the early 1980s, and the promise of higher crop prices

disappeared. From 1980 to 1987, farmland values plummeted 5.2 percent annually.

Another, less dramatic period of agricultural prosperity appeared briefly in the mid-1990s. By 1995, a decline in crop production had tightened world grain inventories again, and economic growth had boosted food demand in developing nations, especially in Asia. The dollar had lost ground against global currencies, and U.S. food products were again more competitive in foreign markets. The result was renewed strength in U.S. agricultural exports, which rose 42 percent from 1990 to 1996. When strong demand again outpaced production gains, world grain inventories started to decline. The lean supplies drove crop prices to record highs in 1996, and farmland values soared.

The prosperity vanished quickly. Global crop production rebounded, while the Asian financial crisis slashed world economic growth, strengthened the dollar, and prompted U.S. agricultural exports to drop 14 percent from 1996 to 1998. Meanwhile, the average annual price for corn dropped from $3.24 in 1995 to $1.94 in 1998.

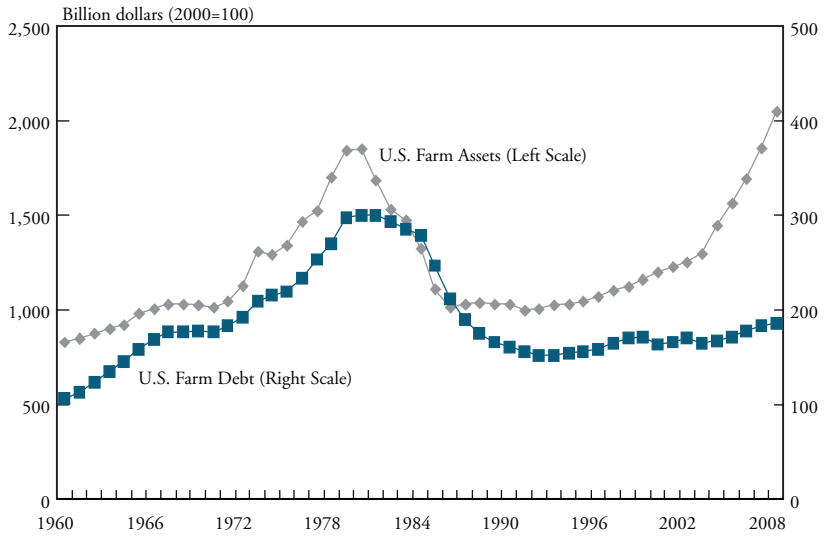
In contrast to the 1980s, farmland values dropped more moderately, as government subsidy payments propped up farm incomes. From 1998 to 2002, the U.S. agricultural sector received $18.4 billion annually in government payments, mostly through emergency payments, which accounted for 38.2 percent of U.S. net farm income. These subsidy payments were quickly capitalized into farmland values. In 2000, the U.S. Department of Agriculture (USDA) reported that government payments accounted for 30 percent of national farmland values—and in some regions up to 70 percent (Ryan and others). By 2004, some analysts estimated that 45 percent of the value of Iowa farmland was derived from government payments (Barnard and others; Duffy; Holste). In 2008, with rising crop prices, farmers are expected to receive $11 billion in government subsidy payments, accounting for just 14.5 percent of net farm incomes and a smaller share of farmland values.

II. THE FINANCIAL AFTERMATH OF BOOMS

Rising farmland values strengthen farm balance sheets. In fact, farmland accounts for 85 percent of the asset base of the farm sector. Thus, changes in farmland values—either up or down—have major implications for the financial health of the farm sector.

Chart 4

U.S. REAL FARM ASSETS AND DEBT



Source: USDA

Today's rising farmland values have improved the health of farm balance sheets. With climbing farmland values, USDA forecasts that farm assets will rise 13.1 percent in 2008, with 14.9 percent gains in real estate assets (Chart 4). Asset levels are expected to outpace debt levels, pushing farm debt ratios to record lows. Total farm debt is forecast to rise 3.7 percent in 2008 with bigger gains in non-real estate debt. Federal Reserve agricultural credit surveys suggest that capital spending will strengthen in 2008. In the first three months of the year, farm machinery sales have surged, with combine and four-wheel drive tractor sales up 10.8 and 30.9 percent, respectively (U.S. Ag Flash Report).

As capital spending rises, so do questions regarding debt accumulation. The 1980s farm bust was especially painful due to debt accumulation. In the late 1970s, real interest rates fell sharply, resulting in negative real interest rates on farm real estate loans in 1979. Low real interest rates enticed farmers to pay for capital expenditures with debt financing. Farm debt levels mounted 12.9 percent annually during the 1970s. By 1980, farmers held more debt than they could repay. The sharp rise in interest rates needed to combat inflation raised debt carrying costs. Farmers who had refinanced debt with inflated land values

as collateral faced significant financial problems when the land values plummeted (Duncan). The result of eroding farm collateral and falling farmland values led to a surge in farm bankruptcies and in agricultural bank closings.[2]

Today, farm debt levels are low. And, despite the brisk rise in farm capital investments, farm debt is expected to rise only modestly this coming year. The expected 3.7 percent rise in 2008 farm debt is the smallest gain in the last five years, a time when low interest rates fueled faster debt accumulation by farmers. Recent declines in interest rates have reduced debt carrying costs, giving farmers an added incentive once again to use debt financing to pay for capital expenditures. Thus, some analysts are concerned that farmers may expand debt only to see higher production costs or lower prices reduce farm revenues and land values in the future. Fortunately, unlike the 1970s, anecdotal reports suggest that lenders are justifying farm loans on cash flows rather than on collateral from escalating farmland values.

III. ARE CURRENT GAINS IN FARMLAND VALUES RATIONAL?

The historical boom and bust cycles in agriculture have raised concerns about the financial underpinnings of current farmland values. For example, many bankers question the rationality behind such large gains (Henderson and Akers). According to economic theory, farmland values are based on the capitalized value of expected economic returns. Based on current crop price and production cost forecasts, crop returns appear to justify the current run-up in farmland values.

The value of farmland, like other income–producing assets, can be derived from the expected flow of future income. As a result, net present value models are typically used as the foundation to evaluate farmland values (Burt, Lamb and Henderson). In these models, the net present value of farmland represents the sum of all future income streams from farming, appropriately discounted to represent the difference between a dollar received at some future date and a dollar today. Assuming that an infinite stream of farm income remains constant in the future, farmland values can be determined using a straightforward formula:

$$Value(t) = \frac{Y^e}{r}, \quad (1)$$

where the value of farmland at time t is based on the expectations of net returns to farm production Y^e appropriately discounted at rate r.[3] In this formula, r is the capitalization rate used to value future income streams. As a result, farmland values can vary with changes in incomes Y^e or with changes in the capitalization rate, r. In general, rising incomes will lead to higher land values, while falling incomes will cause land values to decline. In contrast, farmland values move inversely with the capitalization rate. Higher capitalization rates lead to lower land values, while lower rates lead to higher values.[4]

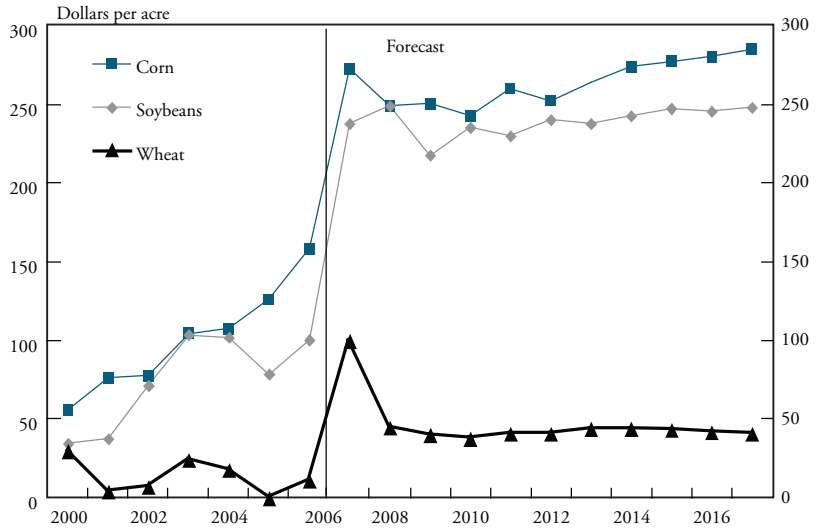
Historical cost and returns data for crop production and projections for crop prices, production costs, and yields can be used to estimate expected net returns to cropping. Each year, the USDA provides historical cost and returns data for major U.S. crops at the national level and for various farm production regions. Production costs include variable costs (seed, fuel, fertilizer, and chemicals) and fixed, operating costs (land, labor, taxes, and depreciation). Production costs are weighted to include both irrigated and nonirrigated crop production. Production costs excluding land are calculated by subtracting land costs from total production costs.

While USDA's historical cost data allow for the calculation of past profits, projected production costs obtained from the Food and Agricultural Policy Research Institute (FAPRI) are used to forecast expected profits. Each spring, FAPRI provides a ten-year projection for crop production costs.[5] In March, FAPRI projected that crop production costs would rise 5 percent in 2008 after a double-digit surge in 2007. Production costs are expected to slow after 2009 with lower crude oil prices that are expected to fall below $74 barrel after 2009, well below current levels.

Given production cost estimates, gross revenue forecasts are needed to calculate estimated net returns. Gross revenues are derived from market-based revenues and government subsidy payments. Market revenues are based on the average per acre crop yields multiplied by price. Crop

Chart 5

PROJECTED NET RETURNS TO LAND FROM U.S. CROP PRODUCTION



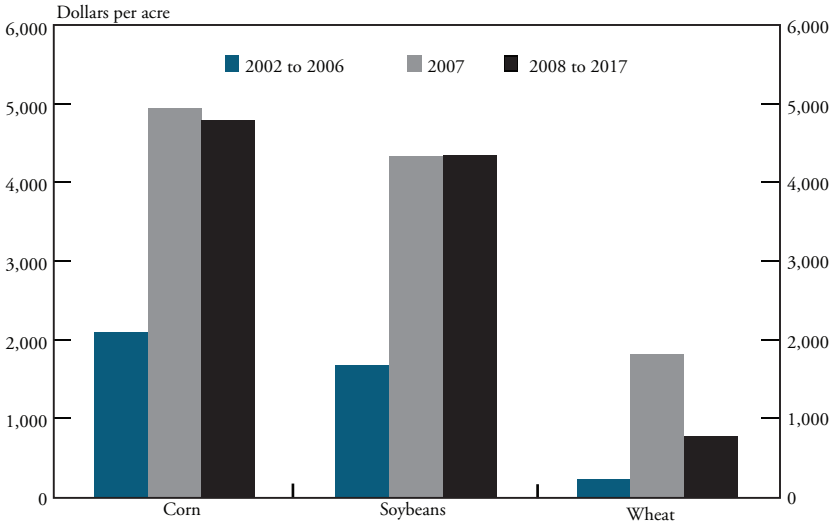
Calculations based on USDA cost and returns data and FAPRI forecasts of crop prices, yields and production costs.

price and yield projections were also obtained from FAPRI forecasts.[6] In general, FAPRI estimated a steady rise in crop yields through 2017.[7] Crop prices are projected to remain high in 2008 and 2009 with stronger export and ethanol demand keeping supplies near historical lows. However, between 2010 and 2012, prices are expected to decline slightly as increased production boosts crop inventories. Crop prices are expected to rebound after 2012 as stronger export growth and domestic demand outpace production gains, leading to tighter crop inventories. Due to high crop prices, FAPRI projected that crop producers would only receive the fixed portion of direct government payments through 2017.

Historical data from USDA and projected prices, yields, and government payments from FAPRI were used to calculate expected net returns to cropland from corn, soybean, and wheat production from 2000 to 2017.[8] After rising sharply in 2007, net returns to land are expected to retreat in the near term (Chart 5).[9] Due to elevated energy

Chart 6

PROJECTED CAPITALIZED NET RETURNS TO LAND FROM U.S. CROP PRODUCTION



Calculations based on USDA cost and returns data and FAPRI forecasts of crop prices, yields, and production costs. Capitalization rate of 5.5 percent was used for the whole time period.

prices, production costs are expected to rise sharply and limit profits. Moreover, crop prices are expected to decline as farmers expand production globally in response to larger 2007 profits.

The timing of the decline in net returns follows the rebound in crop supplies. For example, 2008 wheat returns are expected to drop sharply as drought conditions ease globally, fostering a rebound in world production, which in turn pushes prices lower. In contrast, soybean returns are expected to decline in 2009 when the potential production response from South America serves to limit prices.

After 2009, increasing demand is expected to hold crop returns steady, if not rise, through 2017. Corn and soybean profits are expected to rise steadily from 2010 to 2017. In contrast, wheat profits are expected to remain flat after declining in 2009.

Using the capitalization formula in equation 1, capitalized net returns to land, or projected land values, are expected to rise sharply above 2006 levels (Chart 6). A capitalization rate of 5.5 percent, the average

rate for cropland in the Corn Belt and Great Plains over the past decade, was used to capitalize net returns.[10] Over the next decade, corn and soybean returns are projected to support land values ranging from $4,300 to $4,800 per acre, more than 130 percent above 2002 to 2006 levels. The biggest percentage gains, however, could emerge from wheat production, where projected land values average $765 per acre over the next decade, well above 2002 to 2006 levels. However, this sharp increase was exaggerated by low profit levels associated with drought-reduced wheat harvests between 2002 and 2006. In sum, comparing historical and expected returns indicates that farmland values could rise sharply.

Farmland values, however, are based on expected returns, not necessarily historical revenues. So, how do current profit expectations compare with past forecasts? When expected profits and capitalized returns using the current 2008 forecast are compared with estimates based on the 2006 and 2007 FAPRI forecasts, farmland values are again expected to rise (Chart 7). But, in this case, the biggest percentage gains are expected in soybean production, where stronger price gains and lower production cost increases are expected to boost returns and support a rise in projected land values from $841 to $4,319 per acre. Rising corn returns are expected to support land value gains from roughly $2,200 to $4,700 per acre. Finally, wheat production is expected to support rising land values as well, reaching almost $800 per acre.

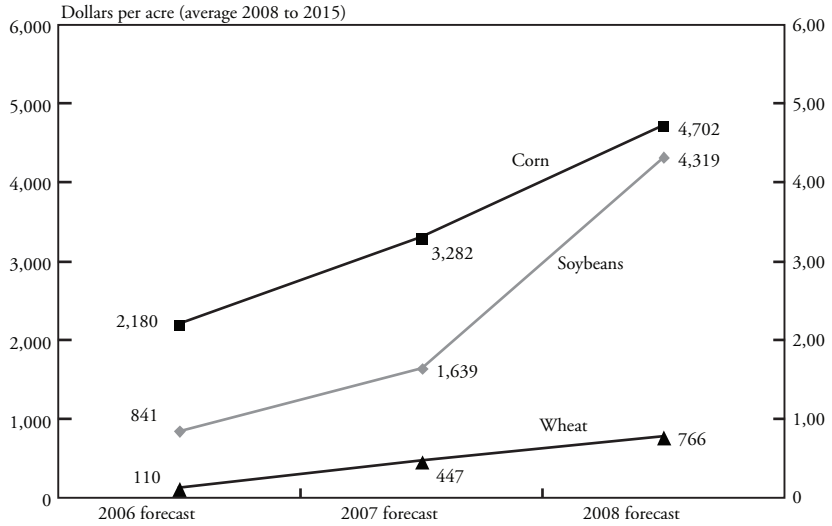
Cropland values are also projected to vary across farm production regions. Regions more suitable to crop production are expected to have larger land value gains. For example, returns to corn production were calculated for four USDA farm production regions—the Heartland, Northern Crescent, Prairie Gateway, and Northern Great Plains—regions that account for most of U.S. corn production (Map 1). Corn returns and thus land values were the largest in the Heartland, a region with higher corn yields and lower production costs. The Prairie Gateway and Northern Crescent had significantly lower capitalized returns.

When compared to current cropland values, recent farmland value gains appear to be rational. For example, in the Heartland, projected land values based on corn returns averaged almost $6,000 per acre from 2008 to 2015, well above 2007 average cropland values in the Corn Belt (Map 2). Moreover, in the Prairie Gateway, where roughly 80 percent of corn production is on irrigated land, the projected land value of

Chart 7

CAPITALIZED NET RETURNS TO LAND FROM U.S. CROP PRODUCTION

(2006, 2007, 2008 Forecasts)

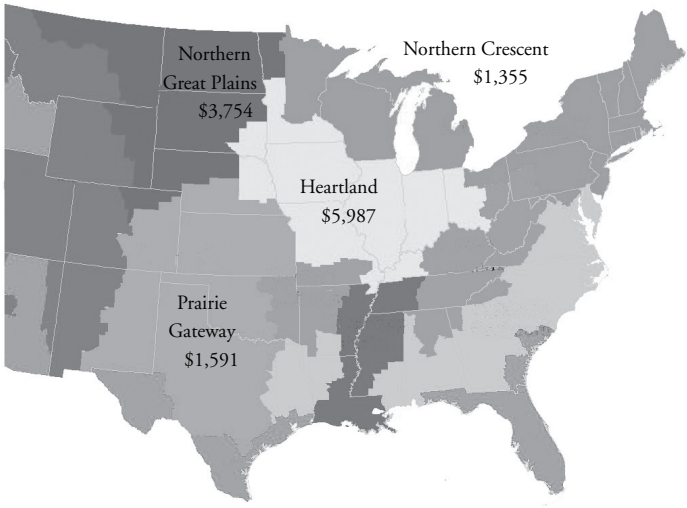


Note: Calculations based on USDA cost and returns data and FAPRI forecasts of crop prices, yields, and production costs.

Map 1

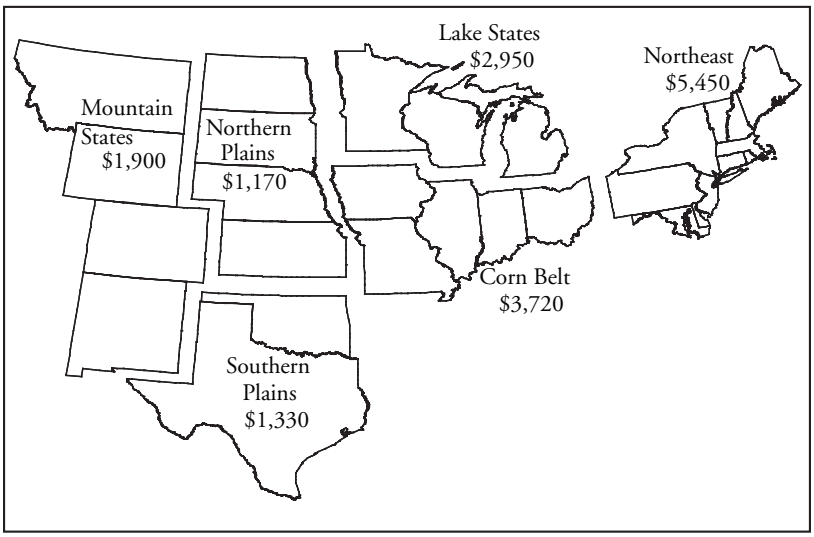
CAPITALIZED RETURNS TO CORN PRODUCTION BY USDA FARM RESOURCE REGION

(Average 2008 to 2017)



Note: Calculations based on USDA data and FAPRI projections.

Map 2
2007 CROPLAND VALUES



Source: USDA

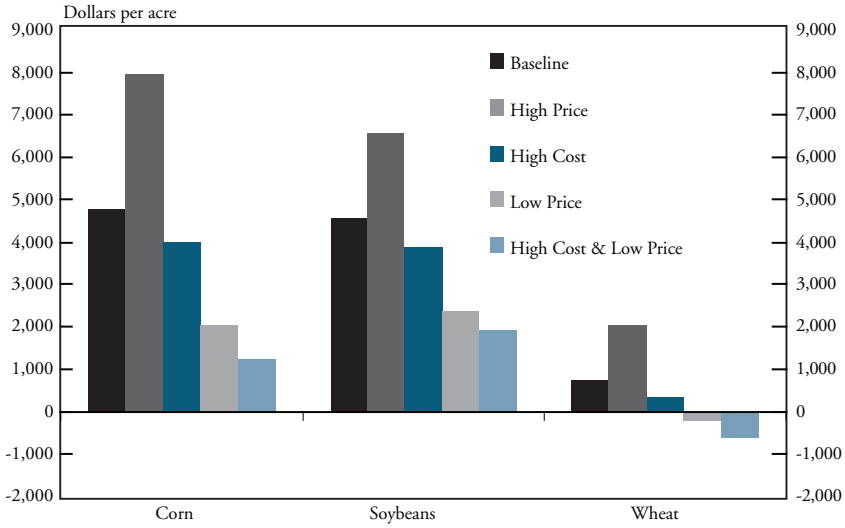
$1,600 per acre is above current cropland values of $1,325 and $1,200 per acre in Kansas and Oklahoma, respectively, weighted to account for irrigated and nonirrigated cropland.

IV. ARE CURRENT VALUES SUSTAINABLE WITH HIGHER COSTS AND LOWER PRICES?

Current projections suggest that expected crop profits could support recent farmland value gains. However, projected profits hinge on the assumptions surrounding production costs and crop prices. Changes in these assumptions dramatically alter expectations regarding the profitability of crop production and resulting strength in farmland values. In particular, higher production costs and falling crop prices present two downside risks to net returns and farmland values. While baseline forecasts project rising farmland values, farmland values could fall with bigger production cost gains or steeper declines in crop prices.

Chart 8

CAPITALIZED NET RETURNS UNDER ALTERNATIVE SCENARIOS



Notes: Under the baseline scenario, production costs excluding land rise 2 percent annually with corn, soybean, and wheat prices averaging roughly $4.00, $10.25, and $5.40 per bushel, respectively, from 2008 to 2017. Under high-cost scenario, production costs rise 4 percent annually from 2008 to 2017. Under low-price scenario, corn, soybean, and wheat prices average $3.00, $7.30, and $4.20 per bushel, respectively. Under high-price scenario, corn, soybean, and wheat prices average $5.00, $13.00, and $7.00 per bushel, respectively.

Risk of rising costs

To determine the risk of rising costs, analysts use alternative scenarios that allow crop prices and production costs to fluctuate. One risk to crop profits and farmland values is that energy prices will remain elevated, resulting in higher-than-anticipated farm production costs. In FAPRI's baseline scenario, production costs were projected to rise roughly 2 percent per year over the next decade as crude oil prices fall below $75 per barrel after 2009. However, after analyzing 500 alternative scenarios, FAPRI reported that 10 percent of the time, crude oil prices remained above $100 per barrel through 2017. In this case, production costs could rise much faster. In fact, following steep crude oil price gains in the 1970s, corn, soybean, and wheat production costs rose roughly 4.0 percent per year.

In this article's analysis, we use a high-cost scenario that assumes a 4.0 percent annual increase in production costs over the next de-

cade. With higher production costs, both crop profits and farmland values decline (Chart 8). Wheat returns and cropland values are cut in half as energy-based inputs—fertilizer, fuel, chemicals—account for a larger portion of variable production costs than for corn and soybeans. In contrast, soybean returns fall the least, 11 percent, as energy-based inputs account for a smaller share of variable costs. Corn returns and projected farmland values drop 17 percent.

Risk of variable crop prices

Fluctuations in U.S. crop prices present both upside potential and downside risks to farmland values. On the upside, stronger crop prices could boost profits and farmland values. On the downside, weak crop prices could slash profits and lead to falling farmland values.

Over the next decade, FAPRI projects crop prices to drop below current levels due to rising supplies and weaker demand. Crop supplies are expected to rise as farmers plant more acres worldwide in response to record-high prices. Moreover, rising crop yields could accelerate with new technological advancement in biotechnology. For example, genetically modified corn could reduce the amount of water needed to grow corn and boost yields or even allow production in more arid regions.

Crop prices could also fall due to weaker demand. Slower economic growth worldwide and a stronger dollar could lead to weaker export activity, reducing the price of U.S. agricultural commodities. FAPRI assumes that world economic growth will ease and that slowing economic growth, especially in developing countries, will trim growth in food demand, placing downward pressure on prices. A stronger dollar is also assumed, which makes U.S. products more expensive to purchase by foreign consumers. At the same time, ethanol demand is expected to rise, which would boost prices. Nevertheless, ethanol is a policy-driven industry, where subsidies, tariffs, and mandates underpin profits in the sector. Policies that substantially reduce ethanol demand could lead to a fall in crop prices.

Alternatively, crop prices could rise further due to changing supply or demand. If world economic growth, especially in India and China, remains robust, demand for agricultural commodities could expand,

placing upward pressure on prices. Moreover, if the dollar remains weak for an extended period, U.S. agricultural commodities would continue to be affordable, boosting demand for U.S. crops.

A weaker dollar would also affect the global supply of agricultural commodities. Because crops are priced globally in U.S. dollars, a falling dollar or rising foreign currencies will reduce the prices foreign farmers receive for their crops. For example, in 2006 soybean prices were $6.43 or R19.29 in the Brazilian real.[11] Today, with a weaker dollar, expected soybean prices for the year will rise to $10.58 per bushel-but fall to R18.52 in the Brazilian real. As a result, U.S. farmers could experience a 64 percent increase in soybean prices, while a Brazilian farmer could face a price decline. The result would be a muted supply response from Brazilian soybean farmers and, in turn, higher prices.

In this analysis, we use two alternative scenarios to allow for the impact of high and low crop prices on crop returns. FAPRI analyzed 500 alternative scenarios that used different assumptions regarding supply and demand conditions. In these alternative scenarios, 10 percent of the time, corn prices remained above $5 per bushel through 2017. Conversely, corn prices fell below $3.00 per bushel 10 percent of the time. Thus, our high-price scenario assumes that corn prices will remain at $5.00 per bushel, and our low-price scenario assumes that corn prices will fall to $3.00 per bushel. Assuming that the ratio of corn prices to soybean and wheat prices remains unchanged, in the high-price scenario soybean and wheat prices will average $13 and $7 per bushel, respectively, through 2017. In the low-price scenario, soybean and wheat prices will average $7.30 and $4.20 per bushel, respectively.

The two alternative price scenarios indicate a wide variation in profits and farmland values. With high prices, projected farmland values are expected to surge further. From 2008 to 2017, elevated corn returns could support farmland values approaching $8,000 per acre, 66 percent above the baseline scenario (Chart 8). At the same time, strong soybean and wheat returns could also support less dramatic surges in farmland values.

Alternatively, with low prices, farmland values could decline. Soybean returns are projected to fall to 2006 levels with corn returns

dropping to 2004 levels. The weaker corn and soybean returns would support projected farmland values in the neighborhood of $2,200 per acre, well below the national average cropland value of $2,700 per acre in 2007. Farmland values would also slide in the Midwest, as low prices yield projected farmland values of roughly $3,500 per acre, slightly below average cropland values in the Corn Belt states in 2007.

Moreover, with low prices, wheat production costs are expected to outweigh revenues, producing negative returns to land. In reality, negative returns would not be sustained perpetually. Producers would slash wheat production and plant alternative crops, and the resulting decline in wheat supplies would boost wheat prices and support higher profit levels. Still, negative returns to wheat production would place downward pressure on the value of land used to grow wheat.

The risk of high costs and low prices

A worst-case scenario would be a period of both low prices and high production costs, reminiscent of the 1980s. In this case, crop revenues would plunge, and farmers would face higher production costs. The result would be a sharp decline in net incomes and plummeting farmland values.

In the 1980s, falling revenues and rising production costs led to a crash in farmland values. World economies slowed in the 1980s after an extended period of above-average economic growth. Coupled with a strong dollar and the Russian grain embargo, U.S. exports collapsed along with crop prices. In 1982, corn and soybean prices plunged 33 percent below the 1980 high. At the same time, production costs rose sharply, jumping more than 5 percent annually. As a result, net returns dropped and farmland values plummeted. On a real basis, national farmland values fell sharply in 1982, losing 40 percent of their value by 1987.

Another period of low prices and high production costs could usher in another sharp decline in farmland values. Assuming low prices and high production costs, crop returns would fall sharply below baseline levels. In fact, net returns to land from wheat production would be negative. Corn and soybean returns would fall sharply below baseline levels, and projected farmland values from corn and soybean production would fall 54 and 30 percent below current farmland values, respectively.

V. CONCLUSION

U.S. farmland values surged in 2007, and additional gains are expected, given current production costs and crop prices. The drivers of today's boom market—short crop supplies and strong demand emerging from robust world economic growth and a weaker dollar—are strikingly similar to past agricultural booms, although ethanol is a unique factor supporting the current boom. In the past, farmland value booms quickly soured with increased world crop production and weaker demand, raising questions about the sustainability of current farmland values. Clearly, the outlook for U.S. farmland values depends on global crop production and crop demand emerging from ethanol production and export activity.

With farmland accounting for the bulk of U.S. farm assets, changes in farmland values have major financial implications for the farm sector. Rising farmland values have boosted farm wealth. In combination with low interest rates, farmers may finance capital expenditures with debt. So far, the industry's debt level is up only modestly, but problems could arise if financial leverage climbs and recent profit gains prove temporary. Fortunately, unlike the 1970s and 1980s, debt ratios are near historical lows, and farmers and their lenders appear to be judging farm loans on cash flows. Thus, rising farmland values may be a sign of a bright, new golden age in agriculture—but they are not without risk.

APPENDIX

HISTORICAL AND PROJECTED CROP RETURNS AND PRODUCTION COSTS

Corn	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total revenues (dollars per acre)	345	338	325	370	393	420	478	629	621	634	632	654	653	668	684	692	701	711
Price (dollars per bushel)	1.85	1.97	2.32	2.42	2.06	2.00	3.04	4.00	3.90	3.92	3.85	3.94	3.88	3.92	3.96	3.96	3.96	3.97
Yield (bushels per acre)	137	138	129	142	160	148	149	151	153	156	158	160	162	164	167	169	171	173
Government revenue (dollars per acre)	92	66	25	26	62	124	24	24	24	24	24	24	24	24	24	24	24	24
Total cost excluding land	289	262	247	265	285	294	319	357	372	383	390	394	401	404	410	415	421	426
Net returns to land	56	76	78	105	108	127	159	272	249	251	242	260	252	264	274	277	280	285
Capitalized returns to land (5.5% cap rate)	1016	1385	1415	1904	1955	2305	2886	4949	4523	4557	4406	4729	4588	4798	4976	5042	5093	5190
Soybeans	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total revenues (dollars per acre)	208	220	223	260	267	256	287	440	461	432	453	451	465	465	474	484	487	494
Price (dollars per bushel)	4.54	4.38	5.53	7.34	5.74	5.66	6.43	10.40	10.58	9.80	10.17	10.04	10.23	10.14	10.26	10.36	10.34	10.38
Yield (bushels per acre)	38	40	38	34	42	43	43	41	43	43	43	44	44	45	45	46	46	47
Government revenue (dollars per acre)	36	46	12	12	25	13	12	12	12	12	12	12	12	12	12	12	12	12
Total cost excluding land	174	182	151	157	165	178	186	202	212	215	218	221	224	227	231	236	241	246
Net returns to land	34	38	71	104	102	78	100	238	249	217	235	230	240	238	243	248	246	248
Capitalized returns to land (5.5% cap rate)	627	685	1298	1887	1859	1424	1824	4332	4531	3948	4277	4182	4370	4324	4418	4505	4474	4512

Wheat	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Total revenues (dollars per acre)	165	148	144	175	171	166	187	292	248	246	248	253	257	262	265	269	274	278
Price (dollars per bushel)	2.62	2.78	3.56	3.40	3.40	3.42	4.26	6.65	5.29	5.23	5.21	5.31	5.35	5.42	5.46	5.51	5.56	5.61
Yield (bushels per acre)	42	40	35	44	43	42	39	41	43	43	43	44	44	44	45	45	45	46
Government revenue (dollars per acre)	52	33	16	21	18	16	15	15	15	15	15	15	15	15	15	15	15	15
Straw/grazing revenues (dollars per acre)	3	3	4	4	6	6	7	7	7	7	7	7	7	7	7	7	7	7
Total cost excluding land	135	144	136	151	153	166	176	192	203	206	209	213	215	218	222	227	232	237
Net returns to land	30	4	7	24	18	0	11	100	45	40	38	41	41	44	44	43	42	41
Capitalized returns to land (5.5% cap rate)	543	68	136	433	326	0	208	1809	819	736	697	744	754	809	795	777	768	748

Data from 2000 to 2006 obtained from USDA cost and returns data.

Data from 2007 to 2017 projected based on FAPRI baseline forecast.

ENDNOTES

[1]Agricultural Credit Survey data from the Federal Reserve banks can be obtained from the Federal Reserve Bank of Kansas City, ***www.KansasCityFed.org*** or from the *Agricultural Finance Databook* available at Federal Reserve Board of Governors, ***www.federalreserve.gov/releases/e15/***.

[2]Farm bankruptcies surged in 1987, with almost 5,000 farm bankruptcies filed in the year ending in June, due in part to changes in bankruptcy laws (Stam and Dixon). Between 1980 and 1990, 327 agricultural banks failed, with a peak in 1987 (Agricultural Finance Databook).

[3]The formula presented in equation is a simplification of standard net present value models assuming that incomes remain constant. Net present values, *Value*, are based on the discounted value of future income streams Y with a discount rate of i. $Value = \frac{Y_1}{(1+i)^1} + \frac{Y_2}{(1+i)^2} + \ldots \frac{Y_t}{(1+i)^t}$. When incomes and the discount rate are constant, the formula can be reduced mathematically to $Value(t) = \sum_{t=0}^{N} \frac{Y_t}{(1+i)^t}$, where N is the number of periods the cash flows are received. When cash flows are infinite, then the net present value formula reduces to $Value(t) = \frac{Y}{i}$.

[4]The capitalization rate represents the rate of return available on a similar, alternative investment. Capitalization rates tend to move with interest rates. Higher interest rates tend to raise capitalization rates, and lower interest rates push down capitalization rates.

[5]Production costs from 2007 to 2017 were estimated by applying FAPRI's expected gains in crop production costs to USDA production cost data. USDA provides a similar baseline forecast in February of each year. However, given the timing of the release, FAPRI's estimates are used because they are more current, released in March 2008. The differences between the USDA's and FAPRI's forecasts are modest. For example, FAPRI and USDA both estimate variable production costs to rise roughly 1.5 percent per year after 2009.

[6]Estimated production costs, crop yields, and crop prices are provided in the appendix.

[7]USDA and FAPRI ten-year baseline forecasts both assume crop yields to rise roughly 1.4 percent per year over the next decade.

[8]The analysis at this stage was limited to the 2000 to 2017 time frame due to the availability of government revenues per acre from the Food and Agricultural Policy Research Institute.

[9]Detailed projections for net returns and capitalized values are presented in the appendix.

[10]Given the concentration of corn, soybean, and wheat production in the Corn Belt and Great Plains, the average capitalization rate for these regions was used instead of the national average. The average capitalization rate of cropland rents into farmland values or rent-to-value ratio for the Corn Belt and Great Plains regions has fallen sharply over the past decade, from 6.0 to 4.2 percent. Increased nonfarm demand for recreational activity and residential construction has contributed to a surge in farmland values with more modest impacts on rental rates. For example, capitalized crop rents account for a smaller share of farmland values in regions with more urban demand. For example, in the Northern Great Plains, the rent-to-value ratio averaged 6.4 percent in the past decade compared to 1.2 percent in the Northeast United States. Capitalization rates also rise and fall with interest rates.

[11]In 2004, one U.S. dollar equaled roughly R3 Brazilian real. In March 2008, one U.S. dollar equaled R1.75 real.

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